



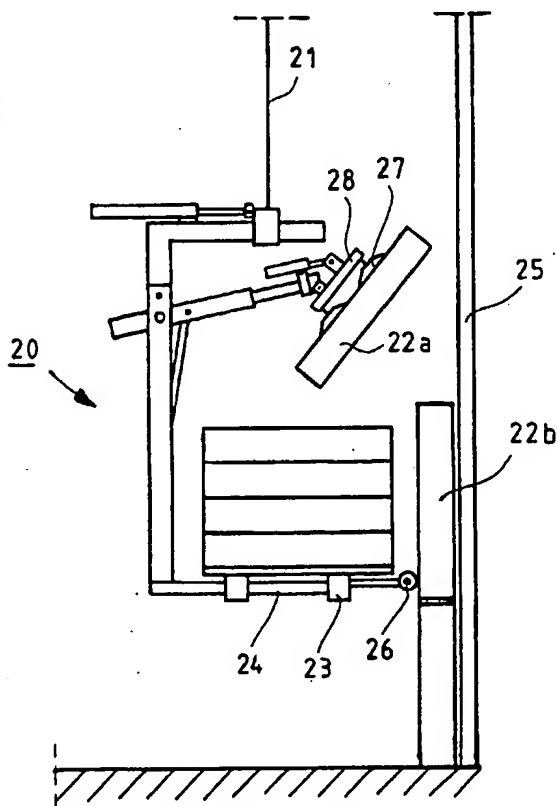
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<p>(21) International Application Number: PCT/FI95/00145 (22) International Filing Date: 17 March 1995 (17.03.95) (30) Priority Data: 941274 17 March 1994 (17.03.94) FI (71)(72) Applicant and Inventor: INKEROINEN, Jukka [FI/FI]; Metsäkuja 4, FIN-21600 Parainen (FI). (74) Agent: PATENTTITOIMISTO KARI PIIRHONEN OY; PI 142, FIN-20521 Turku (FI).</p>		<p>(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG).  Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments. In English translation (filed in Finnish).</p>

(54) Title: METHOD AND DEVICE FOR INSTALLING LIGHT-WEIGHT PANEL UNITS

**(57) Abstract**

A method for installing light-weight panel units according to which the light-weight panel units (22a) are installed on a wall or roof in such a way that at least two panel units at a time are moved to the vicinity of the installation site. After that, the panel units that have been moved are installed in place one by one. The installation device incorporates an intermediate storage unit (20), in which can be stored at least two light-weight panel units (22a). The intermediate storage unit can be moved during installation to the installation site in the vicinity of a wall or roof and it incorporates equipment (28) which transfers one light-weight panel unit at a time to the installation site.



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## METHOD AND DEVICE FOR INSTALLING LIGHT-WEIGHT PANEL UNITS

The object of the present invention is a method for installing light-weight panel units, according to which method a light-weight panel unit is gripped by means of suction cups and moved in its place at the installation site.

According to a known installation method, wall panels to be installed on the walls of a building are lifted up onto the wall one by one. In this case the wall panel unit, which is usually a so-called insulated light-weight panel unit, is gripped by means of suction cups and lifted up on the wall, for example, by means of an articulated jib crane mounted on a truck. This type of crane is disclosed, for example, in the German published application DE-3834311 (E04G 21/16).

However, in applying the above method, the light-weight panel units are easily damaged and the work progresses slowly. Another considerable disadvantage is the fact that the wind catches a single panel unit like a sail, which makes precise positioning of the panel difficult. Strong wind may even make working impossible. The panel unit may swing uncontrollably and thus be damaged or even cause damage to its surroundings.

When a jib crane is used, installation of the light-weight panel unit is restricted to the range of the crane, which means that it cannot be used for installing high walls. In addition, the jib crane carrier vehicle will not be able to enter low premises. The equipment combined with a vehicle is also relatively complex and clumsy for many sites. Furthermore, the floors of premises where installations are carried out are often not strong enough to bear the weight of the vehicle.

- The object of the present invention is to eliminate the above problems and to provide a new method for installing light-weight panel units. It is characteristic of the method relating to the invention that the light-weight
- 5 panel units are installed on a wall or roof, in such a way that at least two panel units at a time are moved to the vicinity of the installation site, after which the panel units that have been moved are installed in their place one at a time.
- 10 By means of the installation method relating to the invention, the panel units can be lifted onto the wall in a substantially safer manner. When several light-weight panel units are lifted at a time, the wind does not affect the stack of panel units in the same way as a single panel
- 15 unit. A single panel unit is picked up from the top of the stack in the immediate vicinity of the wall so that the wind will not be able to affect it adversely. Also, at this stage the transfer distances are so short that they do not bring about the same type of problem as when lifting a
- 20 single panel all the way from the ground. In a stack, the light-weight panel units are also substantially better protected against damage. It is also possible to move the stack in a variety of ways.

The object of the invention also includes a device for

25 installing light-weight panel units, which device (20) comprises at least one suction cup (41), by means of which the light-weight panel unit is moved to the installation site.

It is characteristic of the device relating to the

30 invention

- that the device comprises an intermediate storage unit in which can be stored at least two light-weight panel units, and which intermediate storage unit can be moved during installation to the installation site in the
- 35 vicinity of a wall or roof, and

- that the intermediate storage unit incorporates equipment for moving one light-weight panel unit at a time to the installation site or its vicinity.

The invention is described in detail below by way of  
5 examples, with reference to the appended drawings, in which

Figure 1 shows a side view of the installation device according to the invention.

Figures 2-4 show the installation device of figure 1 at different work stages.

10 Figure 5 corresponds to figure 4 and shows a second embodiment of the installation device.

Figure 6 shows a section along the line VI-VI of figure 5.

Figure 7 shows a detail of figure 6.

15 Figure 8 shows the installation device when connected to a jib crane.

Figure 9 shows the installation device when connected to a forklift truck.

Figure 10 shows the installation device of figure 9 at the second work stage.

20 Figure 11 corresponds to figure 1 and shows a third embodiment of the installation device.

Figures 12-13 show the installation device of figure 11 at different work stages.

25 Figure 14 corresponds to figure 1 and shows a fourth embodiment of the installation device.

Figure 15 corresponds to figure 1 and shows a fifth embodiment of the installation device.

Figure 16 corresponds to figure 1 and shows a sixth embodiment of the installation device.

30 Figure 17 corresponds to figure 9 and shows a seventh embodiment of the installation device.

Figure 18 corresponds to figure 14 and shows an eighth embodiment of the installation device.

35 Figure 19 corresponds to figure 18 and shows the installation device during the second work stage.

Figure 20 corresponds to figure 18 and shows the

installation device during the third work stage.

Figure 1 shows a side view of the installation device 20 according to the invention for installing light-weight panel units, the said device incorporating an intermediate  
5 panel unit storage unit. The device 20 is suspended on a wire cable 21 from a crane which is not shown in the figure. In figure 1, the light-weight wall or roof panel units 22a are stacked on a forklift pallet 23 which is supported by the lifter fork 24 of the device 20. The panel  
10 units 22a are installed against the vertical beams 25 of the wall framework shown in figure 1 so that the installed panel units 22b form an insulated wall structure.

In figure 2, the installation device 20 has been brought against the wall panel units 22b for the purpose of  
15 installing the panel units 22a. During the vertical movement, the support roller 26 resting against the wall is pressed against the surface of the panel unit 22b. The next panel unit 22a is installed in the wall above the previous panel unit 22b installed. To lift the panel unit 22a, the  
20 installation unit 28 of the installation device 20 provided with suction cups 27 is pressed into contact with the surface of the topmost panel unit 22a in the stack.

According to figure 3, the suction cups 27 of the installation unit 28 of the installation device 20 grip the  
25 topmost light-weight panel unit 22a and lift it up onto the wall, against the vertical beam 25 of the wall framework, above the preceding, already installed panel unit 22b.

In figure 4, the panel unit 22a is in place on the wall, after which the panel unit is fastened, for example, by  
30 means of screws.

Figure 5 shows a second embodiment of the installation device 20 according to the invention, in which drilling machines 29a and 29b are incorporated in the installation

unit 28, by means of which machines the light-weight panel unit 22a installed in place can be fastened immediately, for example, with self-drilling screws. In this embodiment, the installation unit 28 also comprises support members 31 moving on guide rails, the members being placeable against and behind the vertical beam 25. The support members 31 thus provide the guidance which guides the drilling machine to the correct location for drilling. The support members 31 also take the force generated in pressing the drilling machine 29. Since a greater feed force can thus be applied, the drilling speed can be substantially increased.

Figure 6 shows the installation unit 28 of figure 6 from another direction. The suction cups 27 of the installation unit 28 have gripped the light-weight panel unit 22a to be installed, which has been lifted in its place against the vertical beams 25, above the preceding wall panel unit 22b. In the centre of the installation unit is an alignment joint 43, by means of which the installation unit can be turned to align with the wall being installed. Another essential property of the alignment joint is, however, the fact that it allows free movement of the installation unit and the panel unit fastened to it into alignment with the wall being installed or the beams of the wall framework. The joint is, therefore, capable of revolving around both the horizontal axes and the vertical axis. The essential aspect is that the grooves of the panel unit being installed are guided freely into the corresponding grooves of the already installed panel unit. The tolerances in question are extremely small, which means that the panel unit to be installed must fall into place in exactly the right position. Otherwise tensions will be formed in the tongue-and-groove joint which prevent the formation of a proper joint. Adjustable limiters can also be installed for the movements of the alignment joint 43.

Figure 6 shows that the installation unit 28 incorporates guide rails 30a and 30b, by means of which the length of

the installation unit can be adjusted in accordance with the width of the panel unit 22a to be installed and correspondingly the installation space. On the sides of the installation unit 28 are drilling machines 29, by means of which the self-drilling screws 32 are fastened. The drilling machines 29, like the support members 31, are incorporated in the adjustable side parts of the installation unit 28. When the support members 31 settle against the vertical beams 25, the drilling machines 29 are at the same time positioned at the fastening points for the screws 32.

Figure 7 shows one end of the installation unit 28 in greater detail.

Figure 8 shows the installation device 20 when connected to a jib crane 33 mounted on a carrier vehicle 34. The device 20 functions in basically the same way as described above. However, the jib crane installation requires a swivelling joint 35 at the end of the jib 36. By means of a device of this type, the light-weight panel unit stack can be moved as such from the truck body directly to the installation site at the wall.

Figure 9 shows the installation device 20 when incorporated in a forklift truck 37. In this case the installation device 20 is lifted by means of the forklift truck's 37 lifter fork 24.

Figure 10 shows the installation of light-weight panel units 22a on a ceiling 38 by means of an installation device 20 incorporated in a forklift truck 37. The forklift truck is advantageous in situations where the installation space is so low that a crane is unable to enter it.

Figure 11 shows a third embodiment of the installation device 20, where the stack of light-weight panel units 22a can be turned by means of an inclination joint 39. The



turning movement is shown in figures 12 and 13.

In figure 13, the panel units 22a which have been turned into an upright position are pushed against the vertical beam 25 of the wall framework so that the panel units 22a  
5 move on a roller mat 40. For the duration of the installation, the device can be anchored to a panel unit 22b already installed in the wall by means of an anchoring suction cup 41.

In figure 13, the panel units 22a move on a roller mat 40  
10 made of soft rubber. The mat can be locked into place for the duration of the turning phase shown in figure 12. Above the panel units 22a is a corresponding soft rubber layer 44, which keeps the panel units in the intermediate storage unit in place.

15 Figure 14 shown a fourth embodiment of the installation device 20 which is equipped with wheels 42. A device 20 of this type is not dependent on a separate crane or the like. It can also be used in extremely low spaces. One person suffices to operate this device 20, and the other above  
20 described devices provided with drilling machines.

Figure 15 shows a fifth embodiment of the installation device 20, where the device has been stabilised by means of a stabilising joint 45 and a stabilising cylinder 46. The device always includes a suction cup 41, a support roller  
25 26 and at least one wheel 42. They can be kept either in the position of use, as the suction cup 41 and support roller are in figure 15, or turned away when not in use, as the wheel 42 in figure 15. The changeover to different positions is carried out by means of the guide rails inside  
30 the lower beam 47, which rails are not shown in figure 15. In this embodiment, the support roller 26 is an air-filled rubber wheel which can, if necessary, also be turned so that the installation device can be moved horizontally sideways.

When the installation device shown in figure 15 is moved, it can be inclined away from the wall by means of the stabilising cylinder 46. The suction cups 41 will then also detach from the wall. Correspondingly, the suction cups can  
5 be made to adhere to the wall by inclining the installation device towards the wall. The suction cups 41 can, however, also be adjusted separately in relation to the support roller 26, that is, be moved towards the wall or away from it.

10 The installation device shown in figure 16 is equipped with a hydraulic unit 55, which incorporates a hydraulic motor 48 that drives both the winch 49 and the transfer wheel 50. This means that the installation device 20 can be suspended  
15 on a wire cable 21 from the ceiling or any other separate point of support 51, such as a trestle. Thus the installation device can be made to move vertically on the wall, independently by means of its own equipment, and no separate crane is needed.

The installation device 20 shown in figure 16 can also be  
20 used to fetch a stack of light-weight panel units 22a. In this case, the support roller 26 is moved along its guide rails to the same point as the wheel 42. However, by means of the stabilising cylinder 46, the device can be inclined so that the transfer wheel 50 is on the ground. Thus, by  
25 means of the transfer wheel 50, the installation device can be moved along the ground in such a way that its lower beams 47 are inserted under the stack of panel units to be lifted.

Figure 17 shows the installation device 20 when mounted on  
30 a forklift truck 37. In this embodiment, the electricity required by the hydraulic unit 55 is fed via a cable 52. Alternatively, the hydraulic system can also be connected to the forklift truck's hydraulic system, in which case no external power source will be required. The installation  
35 device 20 comprises an extendable telescopic jib 53 by

means of which the light-weight panel units 22 can be installed in their place by adjusting the length of the jib 53. It is then possible to install several panel units without moving the forklift truck 37.

5 Figure 18 shows an installation device 20 comprising a hydraulic motor 48 driven by hydraulic unit 55 and a transfer wheel 50 connected to the said motor. The distance of the hydraulic motor 48 from the frame 54 of the installation device can be adjusted. Since the hydraulic  
10 motor 48 is relatively heavy, it can be used to stabilise the installation device. By increasing the distance of the hydraulic motor 48, the installation device 20 is prevented from tipping over, even when the telescopic jib 53 is extended. In this case, the light-weight panel units 22 can  
15 also be moved in their place by moving the installation device 20 by means of the hydraulic transfer wheel 50. Another way of doing this is to adjust the length of the telescopic jib 53.

In figure 18, there are other wheels 21 in addition to the  
20 transfer wheel 50, which wheels can also be turned sideways. When the transfer wheel 50 is also turned sideways, the installation device can be moved sideways, for example in a narrow passage.

In figure 19, the installation device 20 is used to grip  
25 one light-weight panel unit 22a at a time. This is also possible, even when the device has the intermediate storage feature. In figure 20, the panel unit 22a has been lifted against the vertical beam 25 of the wall framework. The installation of the panel unit is carried out either by the  
30 transfer movement of the transfer wheel 50 or by lengthening the telescopic jib 53.

Figure 20 shows that the support roller 26 coming against the wall during the wall installation is turned away as it is not in use, and the wheel 42 is in use. In figures 15

and 16, the situation was the opposite. Correspondingly, in the forklift truck installation shown in figure 17, the hydraulic motor 48 with support structures, as shown in figures 15 and 16, was removed. The hydraulic motor 48 is  
5 intended to be mounted in such a way that it can be installed in place by means of joining elements corresponding to the spikes of a forklift truck.

In figure 20, the installation device 20 can be moved by operating the hydraulic motor 48. The distance between the  
10 hydraulic motor and the frame 54 is also adjustable. The installation of the panel unit 22a can be carried out by moving the entire device or by adjusting the length of the jib 53.

It is obvious to a person skilled in the art that the  
15 various embodiments of the invention may vary within the scope of the claims presented below.

## CLAIMS

1. A method for installing light-weight panel units,  
according to which method a light-weight panel unit (22a)  
is gripped by means of a suction cup (41) and moved in its  
5 place at the installation site, c h a r a c t e r i z e d  
in that the light-weight panel units (22a) are installed on  
a wall or roof in such a way that at least two panel units  
at a time are moved to the vicinity of the installation  
site, after which the panel units moved are installed in  
10 their place one by one.
2. A method as claimed in claim 1,  
c h a r a c t e r i z e d in that the light-weight panel  
unit (22a) that has been installed in its place is fastened  
to the wall or roof, after which the intermediate storage  
15 unit is moved and the next panel unit to be installed is  
taken from it.
3. A method as claimed in claim 1 or 2,  
c h a r a c t e r i z e d in that the light-weight panel  
unit (22a) taken from the intermediate storage unit (20) is  
20 moved sideways and/or vertically to the exact installation  
site.
4. A device for installing light-weight panel units which  
device (20) comprises at least one suction cup (41), by  
means of which the light-weight panel unit is moved in its  
25 place at the installation site,  
c h a r a c t e r i z e d in
  - that the device comprises an intermediate storage unit  
(20) in which can be stored at least two light-weight  
panel units (22a), and which intermediate storage unit  
30 can be moved during installation to the installation  
site in the vicinity of a wall or roof, and
  - that the intermediate storage unit incorporates  
equipment (28) for moving one light-weight panel unit at  
a time to the installation site or its vicinity.

5. A device as claimed in claim 4,  
c h a r a c t e r i z e d in that the equipment  
incorporates a mechanism (28) which picks up one light-  
weight panel unit (22a) from the top of the stack of panel  
5 units in the intermediate storage unit, turns it into  
alignment with the plane of the wall or roof, and positions  
the panel unit in its place at the installation site.
6. A device as claimed in claim 4 or 5,  
c h a r a c t e r i z e d in that the equipment  
10 incorporates a fastening device (29) which fastens the  
light-weight panel unit to the wall or roof before  
transferring the next panel unit from the intermediate  
storage unit to the installation site.
7. A device as claimed in claim 4, 5 or 6,  
15 c h a r a c t e r i z e d in that the device incorporates  
a joint (42), which allows the light-weight panel unit to  
be turned into alignment with the wall.
8. A device as claimed in any of the claims 4 to 7,  
c h a r a c t e r i z e d in that the device incorporates  
20 an adjusting device which allows adjusting movement of the  
light-weight panel unit sideways and/or vertically.
9. A device as claimed in any of the claims 4 to 8,  
c h a r a c t e r i z e d in that the device is suspended  
from a wire cable (21) and an external point of support  
25 (51), and the device has its own lifting device (49).
10. A device as claimed in any of the claims 4 to 9,  
c h a r a c t e r i z e d in that the device is suspended  
from the wire cable (21) of a crane.
11. A device as claimed in any of the claims 4 to 10,  
30 c h a r a c t e r i z e d in that the device is connected  
to the jib (36) of an articulated jib crane (33).

12. A device as claimed in any of the claims 4 to 11,  
c h a r a c t e r i z e d in that the device is connected  
to the lifter fork (24) of a forklift truck (37).

13. A device as claimed in any of the claims 4 to 12,  
5 c h a r a c t e r i z e d in that the device incorporates  
its own power unit (55), so that the device can be moved on  
its own wheels (42, 50) along the ground.

14. A device as claimed in any of the claims 4 to 13,  
c h a r a c t e r i z e d in that the device incorporates  
10 a support roller (26) for resting against the wall or a  
suction cup (41) for adhering to the wall.

15. A device as claimed in any of the claims 4 to 14,  
c h a r a c t e r i z e d in that the device incorporates  
a detachable hydraulic motor (48).

15 16. A device as claimed in any of the claims 4 to 15,  
c h a r a c t e r i z e d in that the wheels (42) and  
support rollers (26) of the device can be moved into and  
away from the position for use.

17. A device as claimed in any of the claims 4 to 16,  
20 c h a r a c t e r i z e d in that the hydraulic motor (48)  
can be mounted on the installation device, to the same  
fastening members as the spikes of the forklift truck's  
fork.

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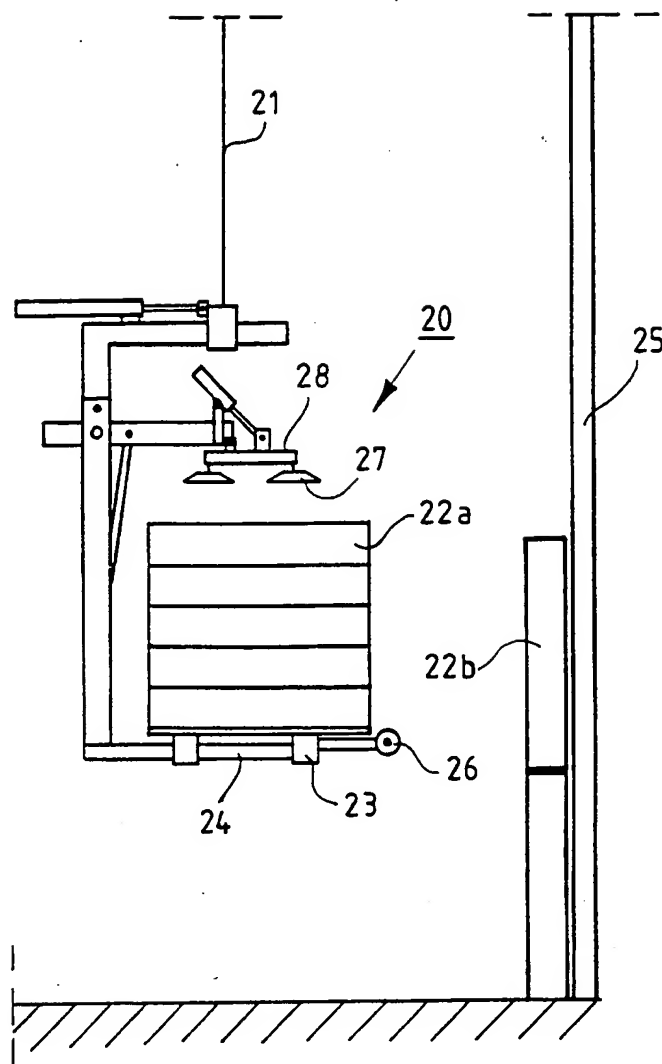


FIG. 1



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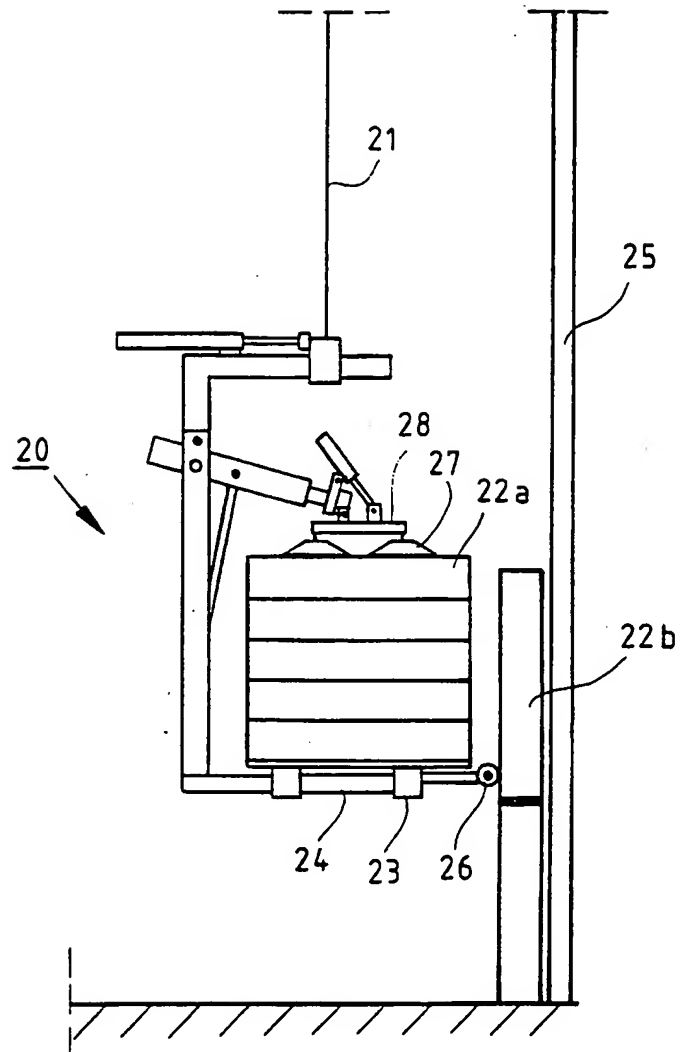


FIG. 2

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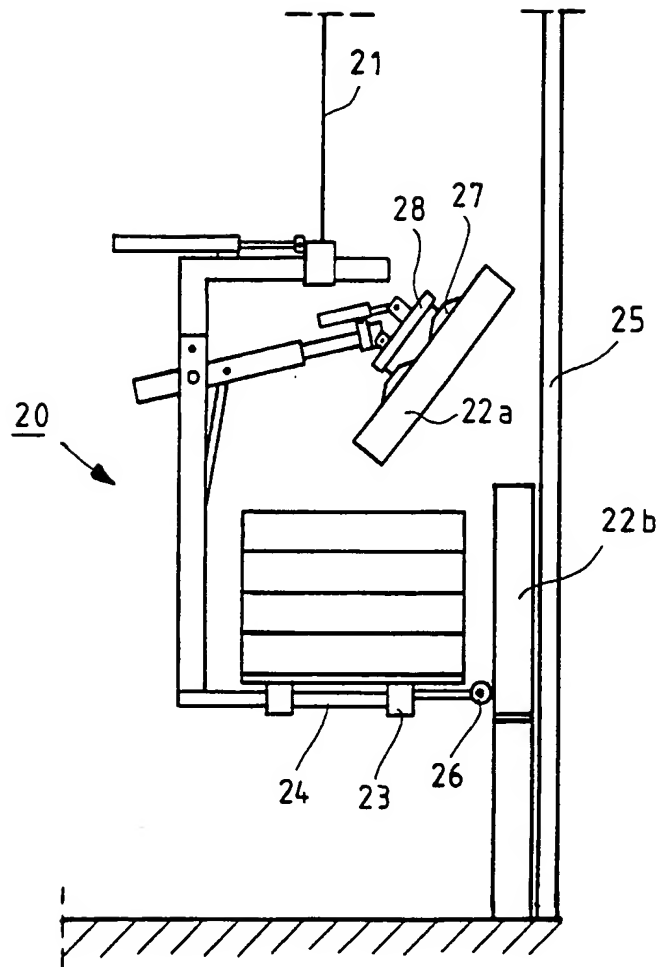


FIG. 3

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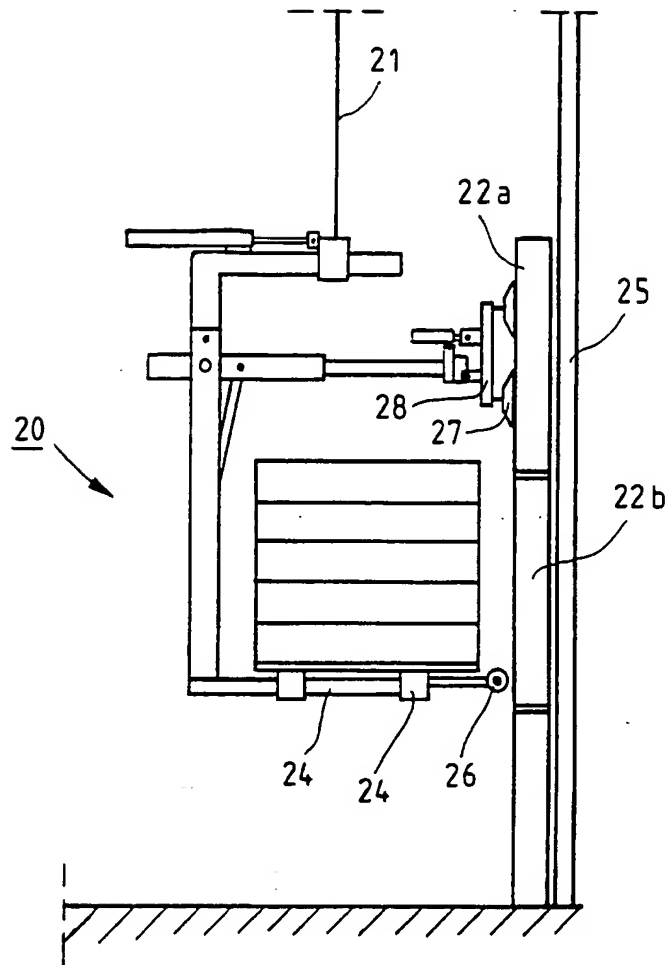


FIG. 4



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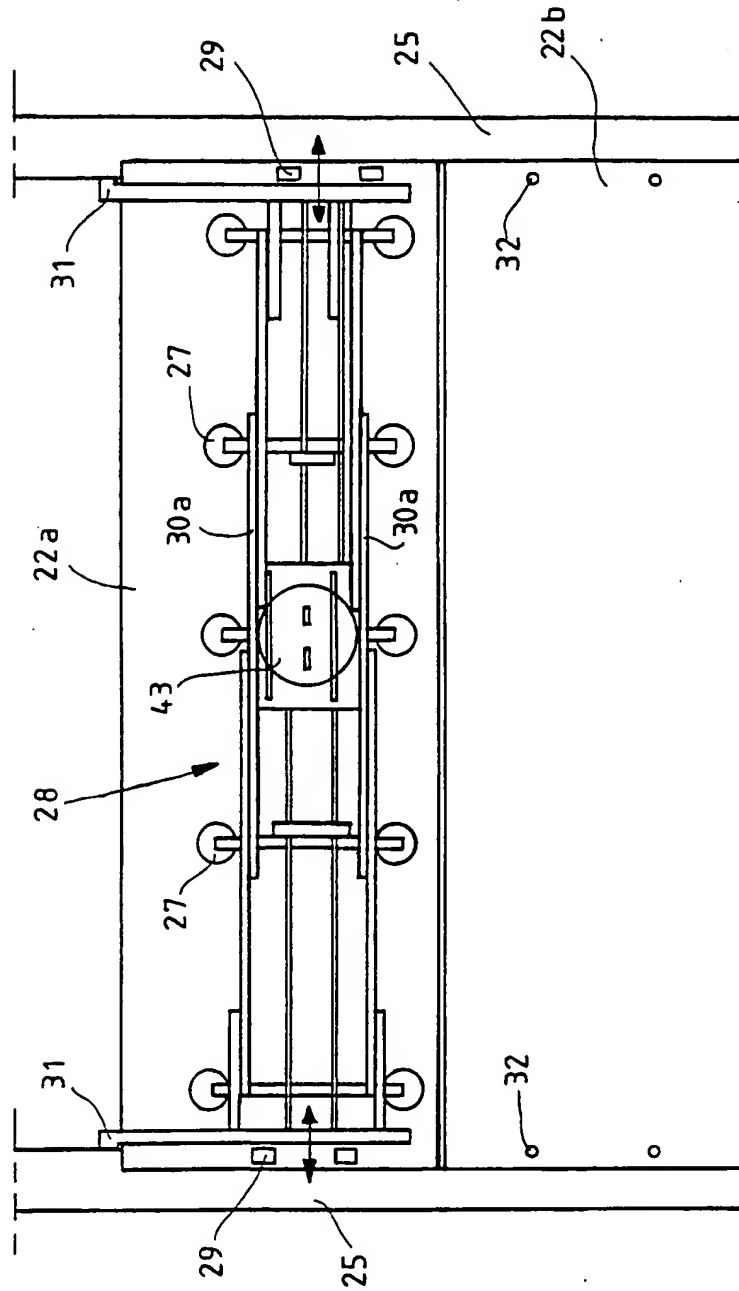


FIG. 6

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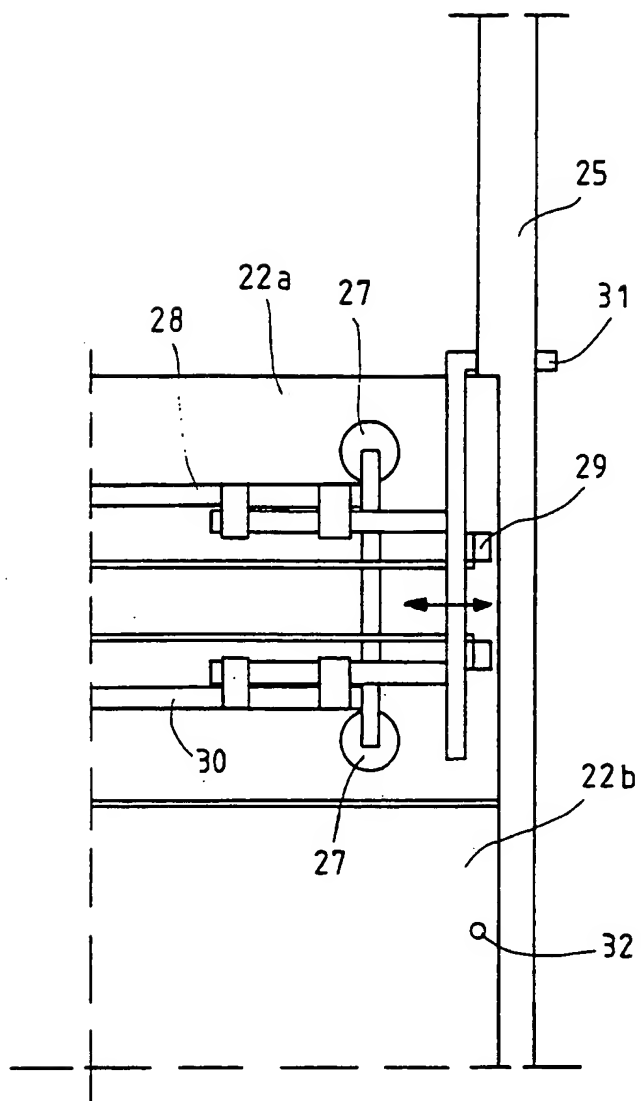


FIG. 7

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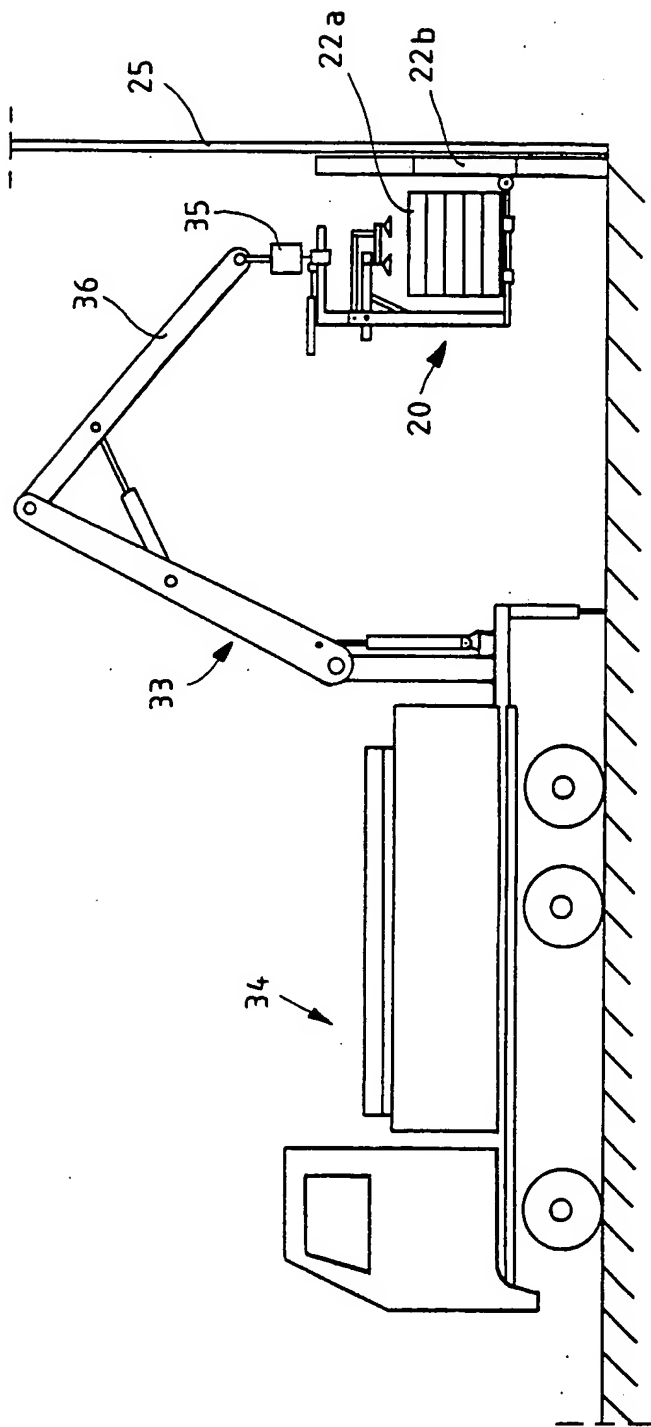


FIG. 8

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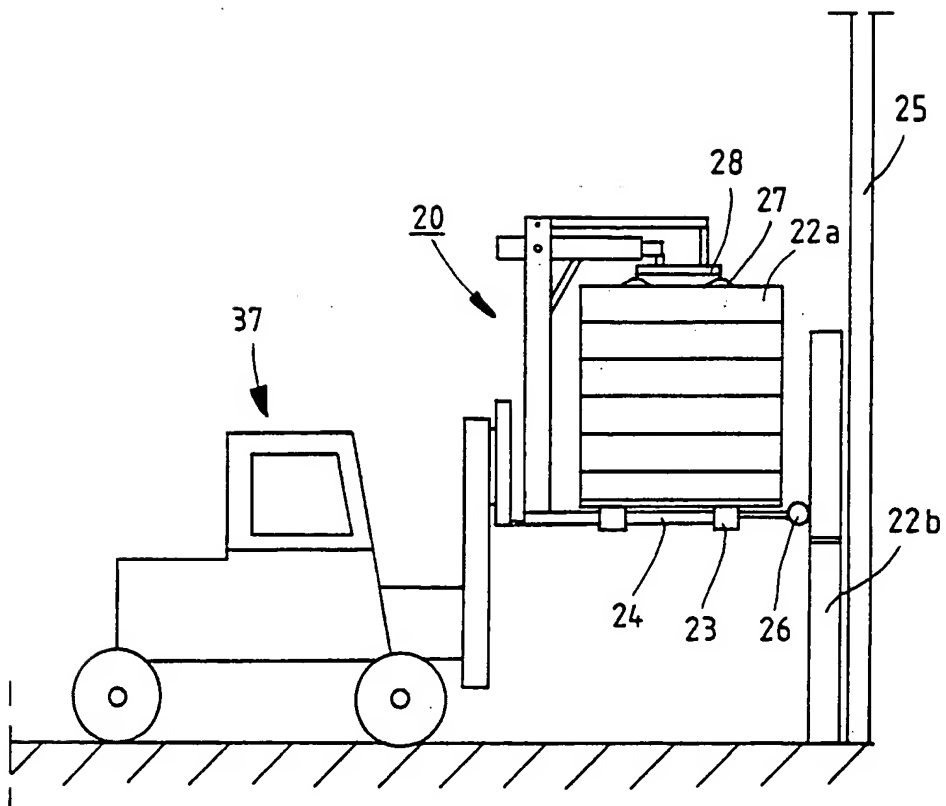


FIG. 9



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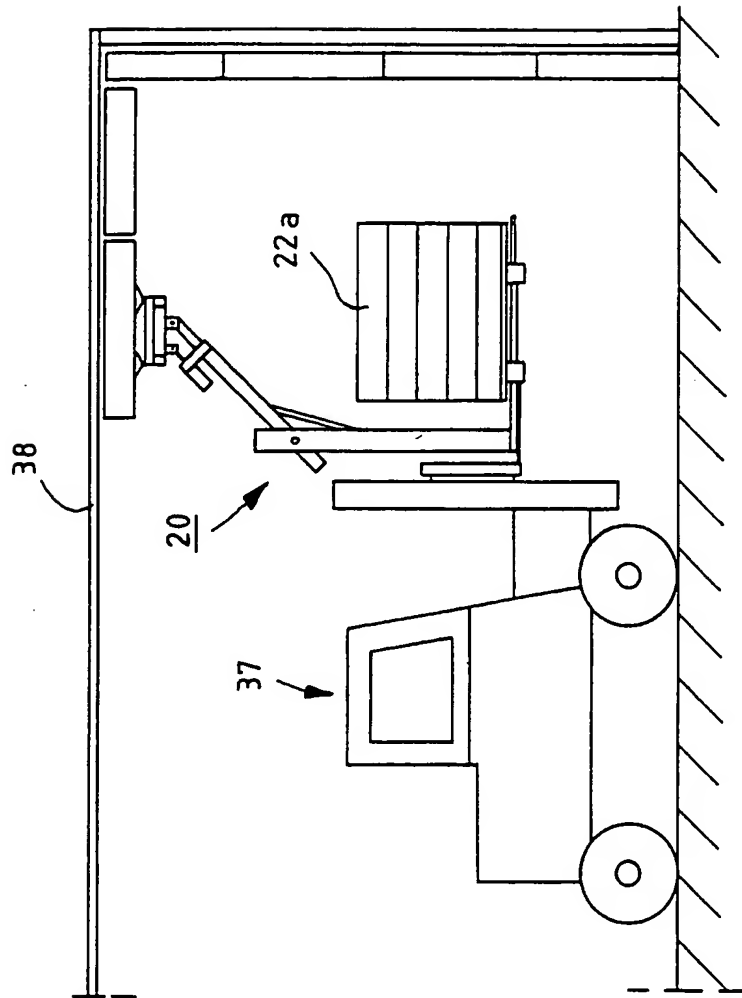


FIG. 10

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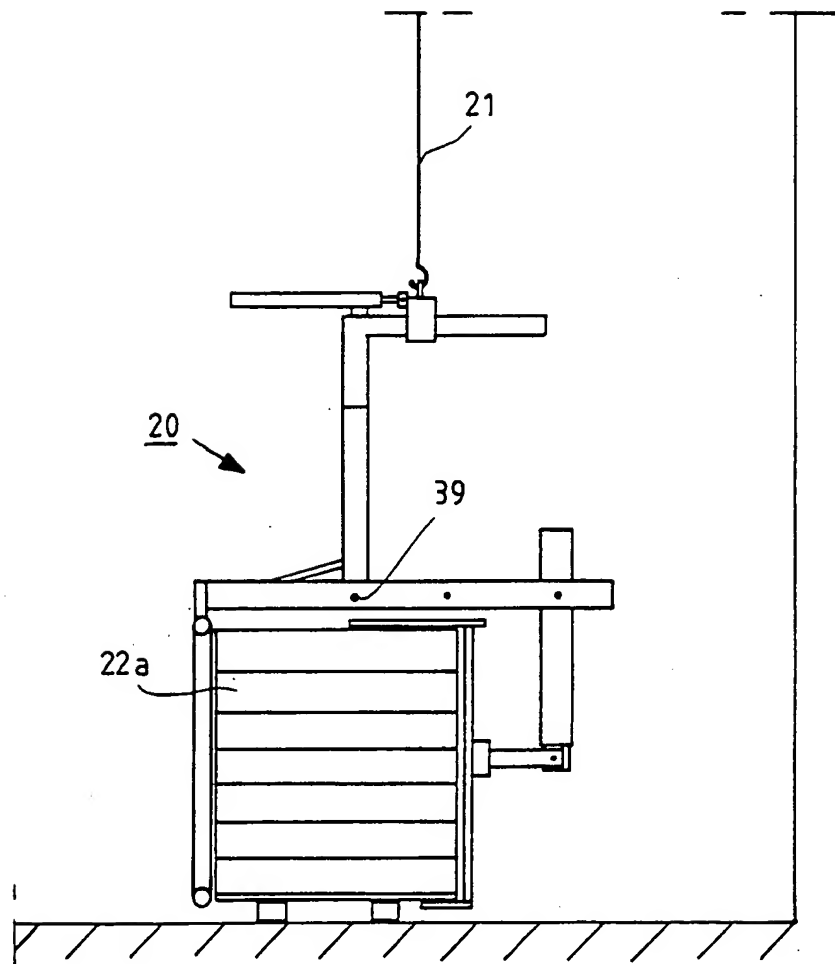
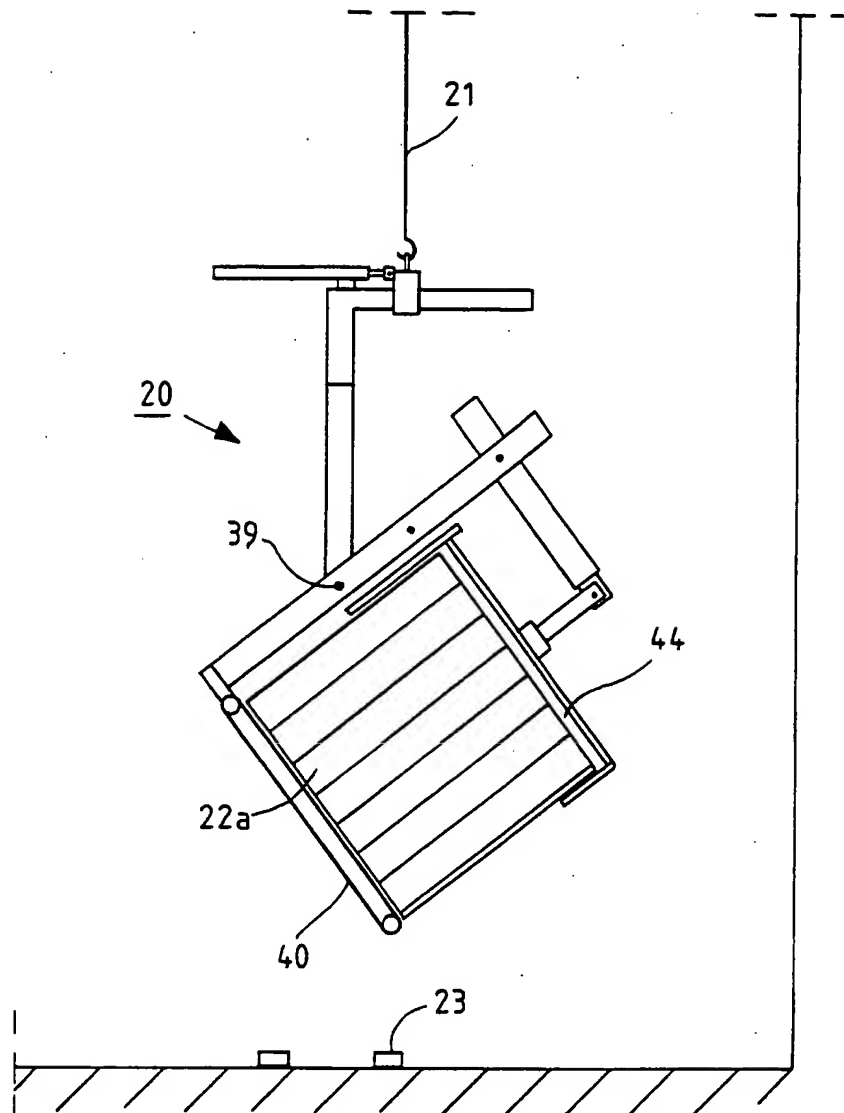


FIG. 11

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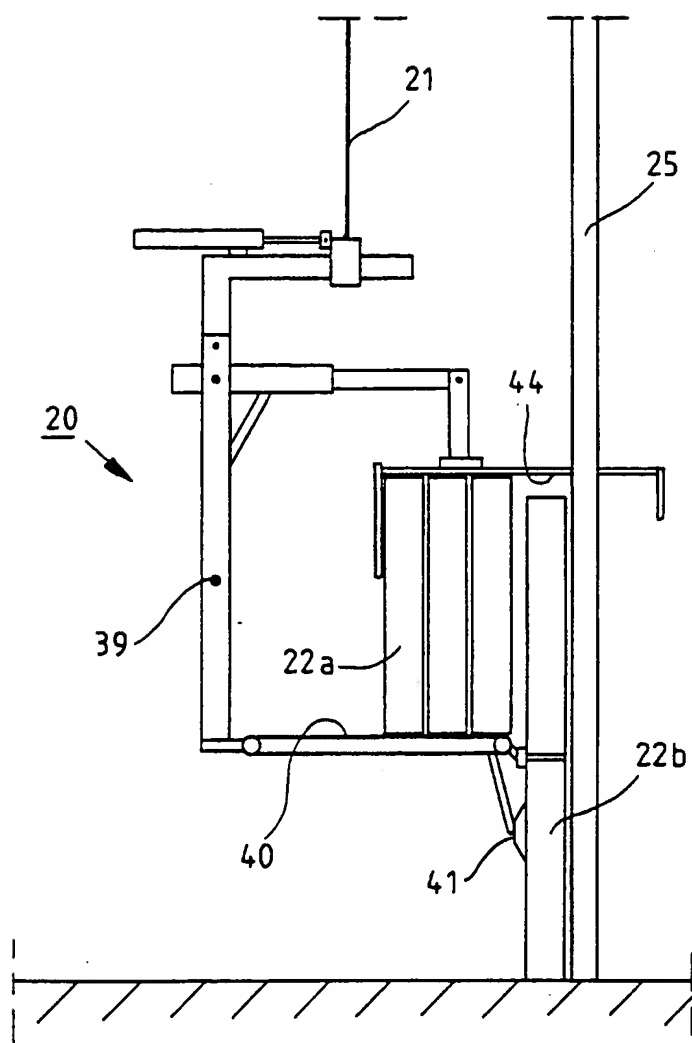
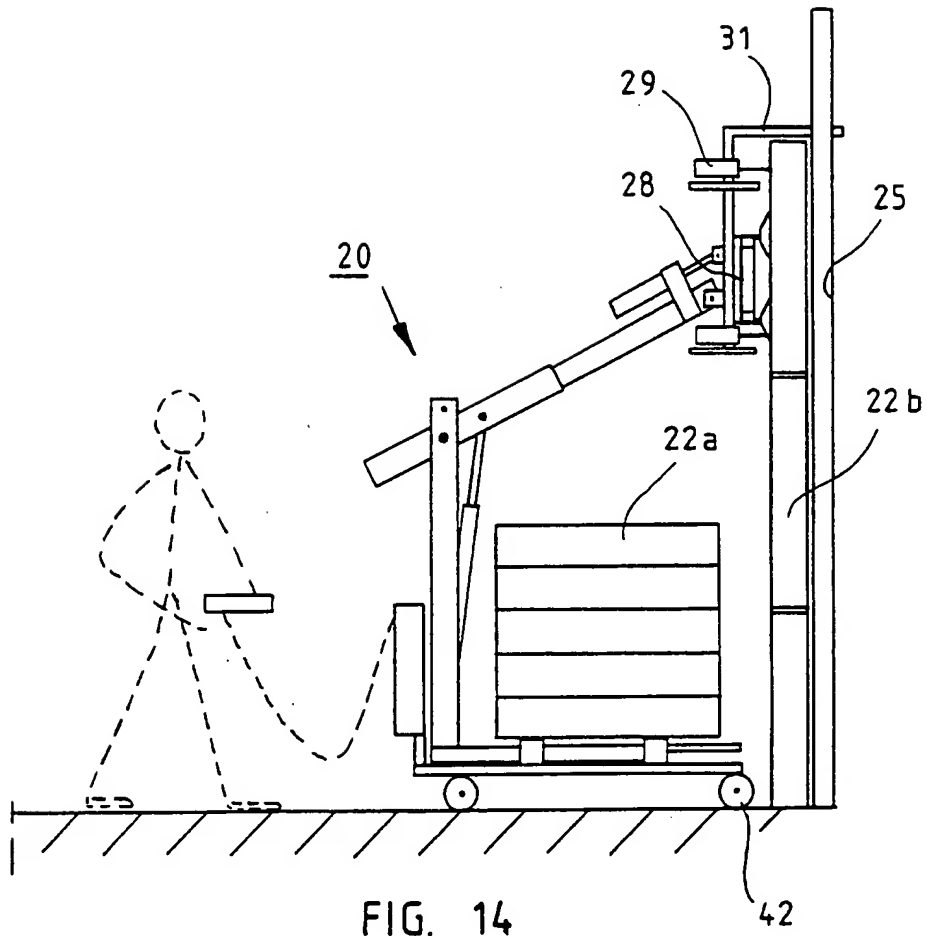
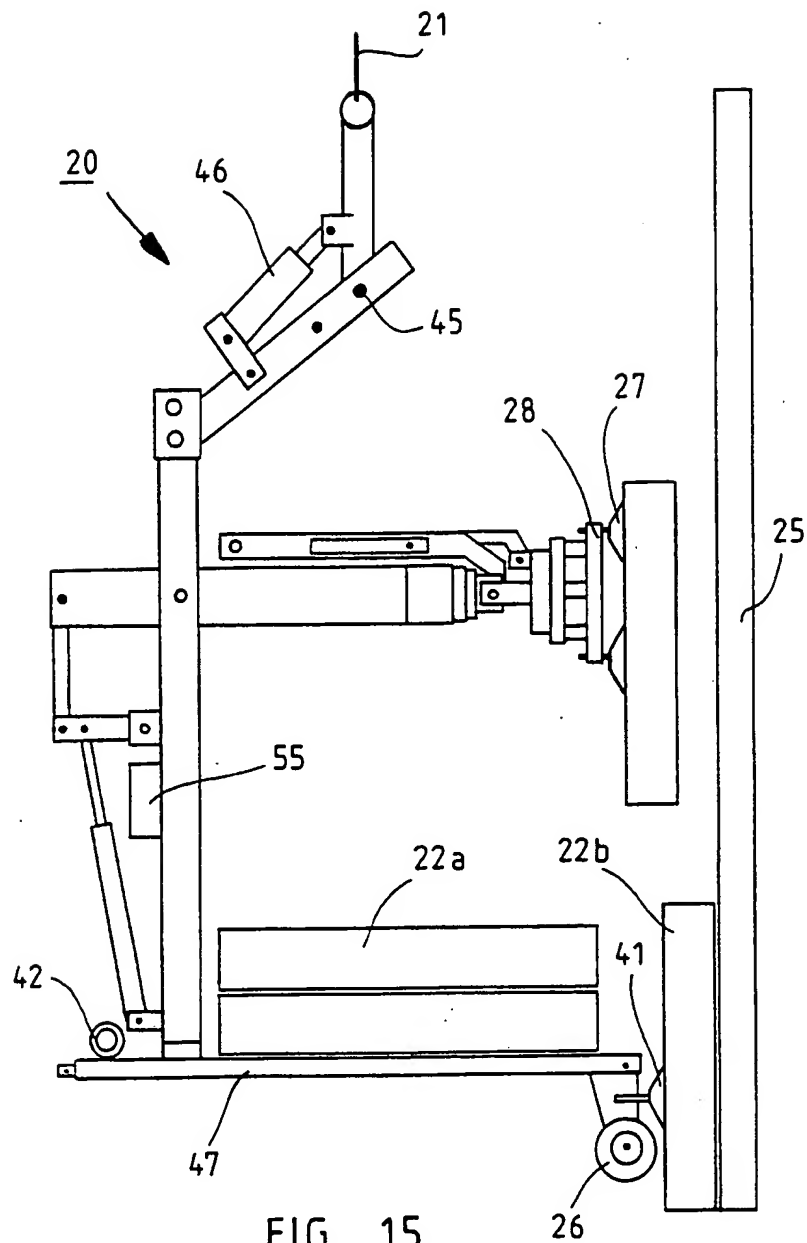


FIG. 13

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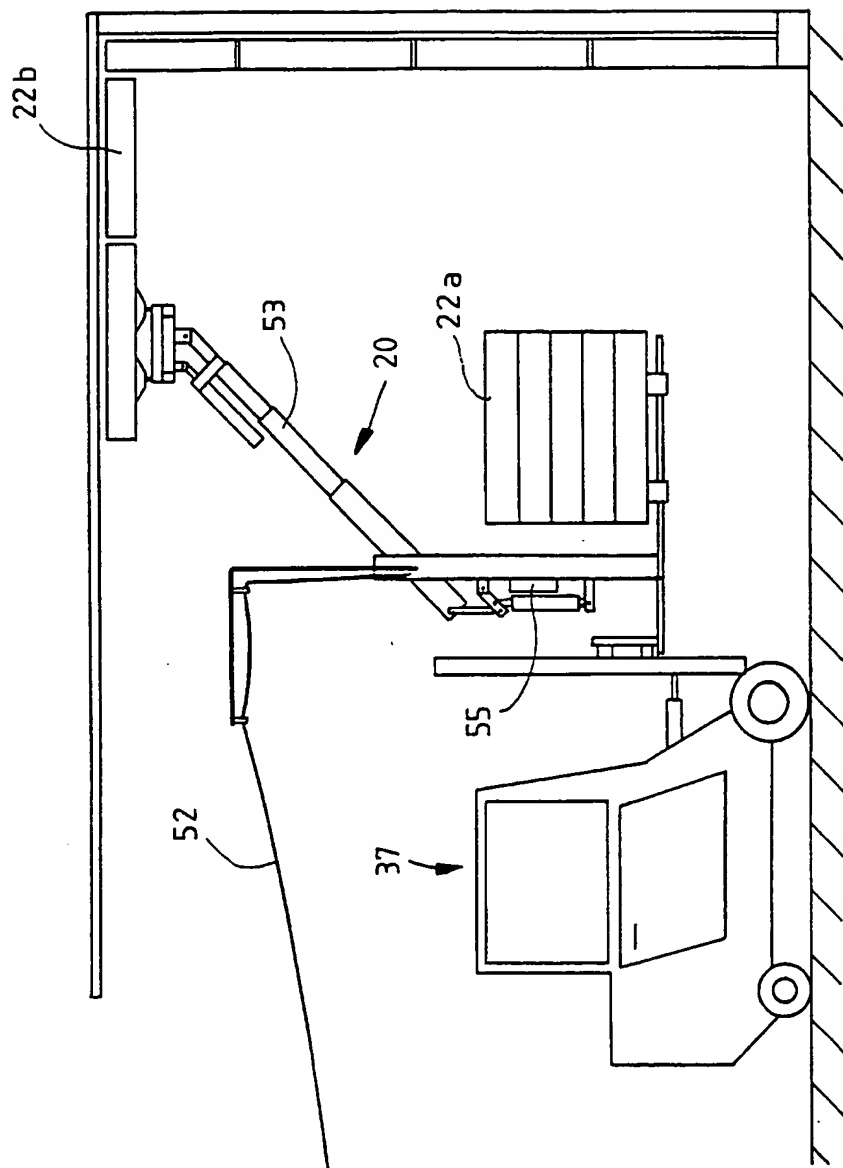
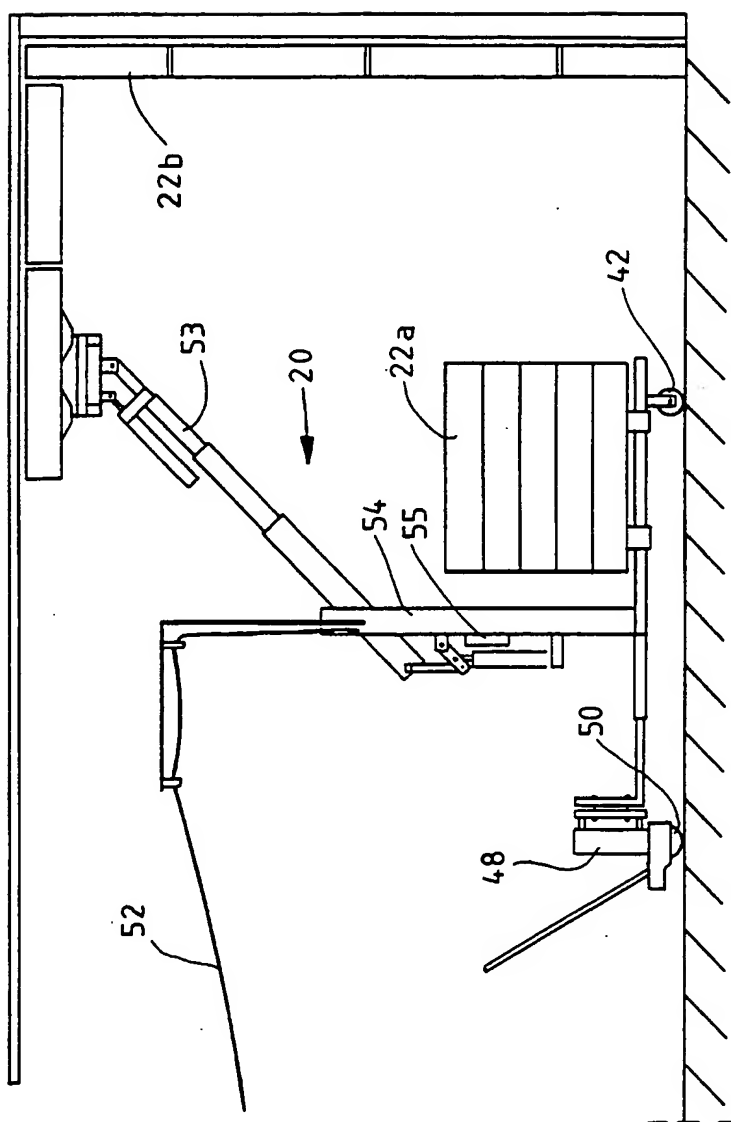


FIG. 17





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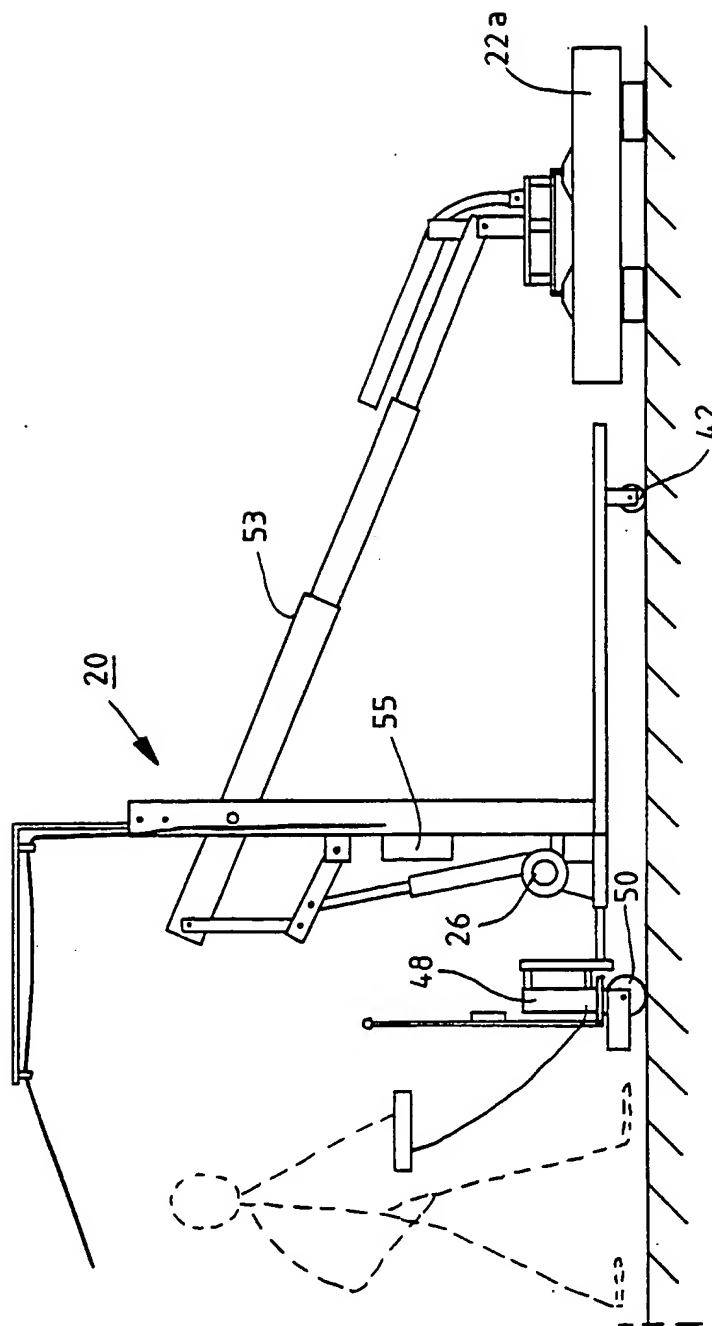


FIG. 19

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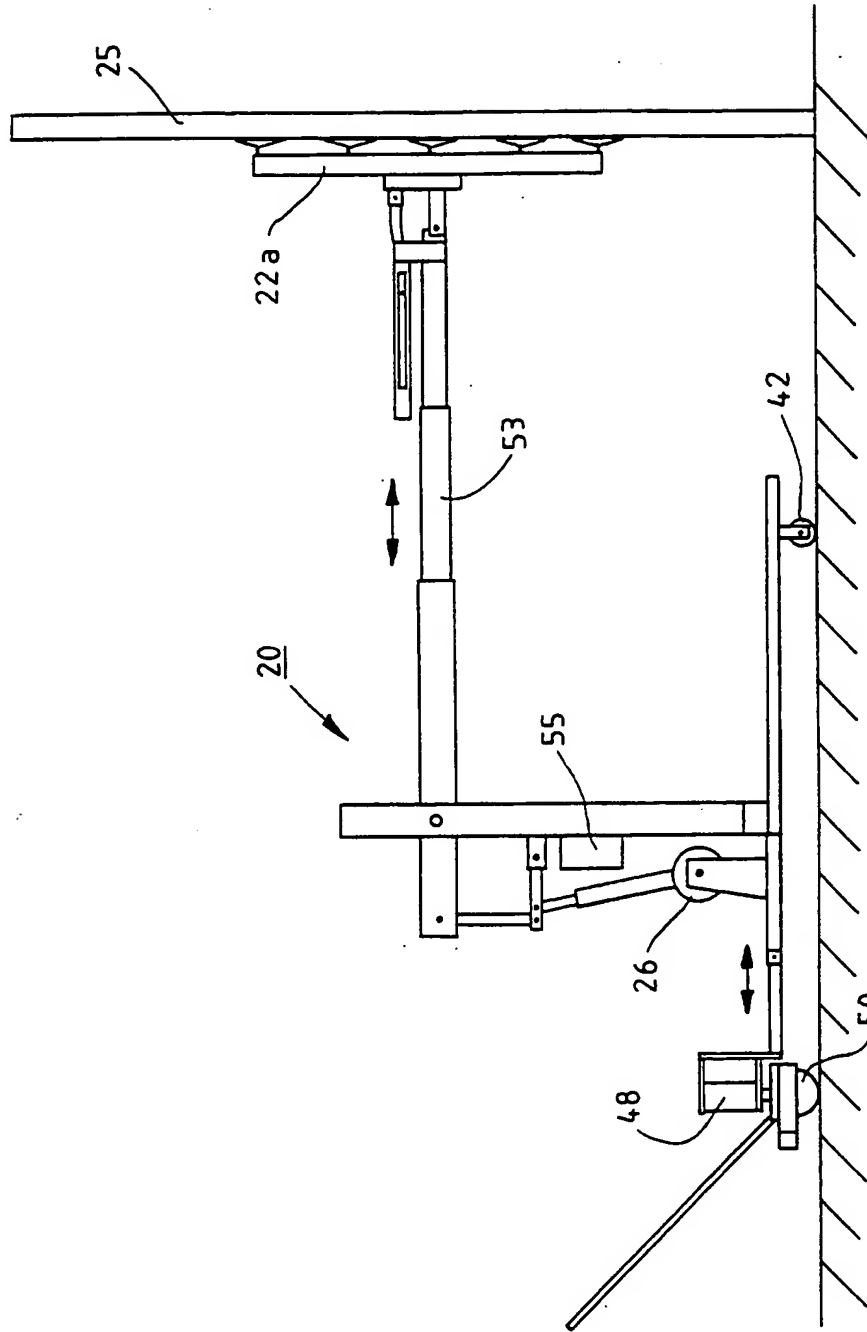


FIG. 20

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 95/00145

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: E04G 21/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B25B, E04G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 3834311 A1 (KESSLER & LUCH - PRODUKTE GMBH), 12 April 1990 (12.04.90)  --	1-17
A	US 4787796 A (MELAN ET AL), 29 November 1988 (29.11.88)  -----	1-17

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

Date of mailing of the international search report

10 July 1995

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

29/05/95

International application No.  
PCT/FI 95/00145

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A1- 3834311	12/04/90	NONE	
US-A- 4787796	29/11/88	CA-A- 1296523	03/03/92
		EP-A,B- 0263979	20/04/88
		SE-T3- 0263979	
		JP-A- 63091485	22/04/88
		LU-A- 86619	03/05/88

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